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SEALE-HAYNE AGRICULTURAL COLLEGE

NEWTON ABBOT, DEVON

Beaumont

Department of Plant Pathology

FOURTEENTH ANNUAL REPORT

for the Year ending September 30th, 1937

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SEALE-HAYNE
AGRICULTURAL COLLEGE

Department of Plant Pathology

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Fourteenth Annual Report of the Department of Plant Pathology

ADVISORY WORK.

Statistics of advisory letters and visits are as follows:—

Advisory Letters.	*Entomological.*	*Mycological.*
Devon	86	175
Cornwall	41	58
External	58	45
Total	185	278
Advisory Visits		
Devon	156	97
Cornwall	56	60
Total	212	157

LECTURES

The Entomologist gave seven lectures on "Farm Pests" to Short Course Students, and a course of ten lectures on "The Principles of Insect Pest Control" to Horticultural and second year Diploma and Degree Students. A new course of twenty lectures on "Insect Pests of Importance in the South-West" was delivered to second year Horticultural Students. In the Lent Term a special advanced course of six lectures was given to Degree Students.

Two lectures and demonstrations on "The Dissection of Bees for Acarine Disease" were given on September 18th and 20th at the Bee Course at the College under the auspices of the Devon and Cornwall Bee-keepers' Associations.

The following lectures have been given by the Entomologist to farmers and growers in the Province.

1936.		
Nov. 12.	Plymouth	"Allotment Pests."
1937.		
Jan. 21.	Braunton	"Bulb Pests."
Jan. 22.	Ilfracombe	"Pests of Vegetables."
Jan. 29.	Coombeinteignhead.	"Pests of Fruit and Vegetables."
Feb. 3.	Tiverton	"Pests of Vegetables."
Feb. 18.	Paignton	"Garden Pests."

A lecture outside the Province was given at the invitation of the Guernsey Growers' Association on "The Efficiency of Bulb Baths" at St. Peter Port, Guernsey, on November 6th, 1936.

The Mycologist gave a course of lectures in Economic Mycology to third year students in the Michaelmas Term. Lectures on fungal diseases were given to Short Course Agriculture students in the Lent Term and also to students of the Short Course in Horticulture. A special course on diseases of local importance was given to second year students in Horticulture.

The following external lectures were delivered by the Mycologist :—

1937.		
Jan. 12.	Totnes	"Diseases of Garden Crops."
Jan. 22.	Coombeinteignhead.	"Diseases of Farm and Garden Crops."
Feb. 18.	Braunton	"Diseases of Narcissi, Tulips, and Iris."
Feb. 19.	Ilfracombe	"Diseases of Garden Crops."
Mar. 18.	Plymouth	"Potato Diseases."

Exhibits were staged at the Commercial Flower Shows at Penzance in March and at Plymouth in April and at the Devon County Show at Paignton and the R.H.S. Chelsea Show in May. A small exhibit was loaned to the Barnstaple Spring Show in March. A large exhibit was staged and demonstrated at the Guernsey Chrysanthemum Show in November, 1936, the expenses of which were borne by the local authorities.

Exhibits were arranged in the laboratory for the Open Field Day of the Devon County Orchards Sub-Committee on June 7th.

ANEMONE INVESTIGATIONS

The main experiment at Seale-Hayne was laid down to study the variation in growth and cropping power of De Caen Anemones on widely differing soils. Two grades of corms were planted, viz: 1-2 cm. and 2-3 cm., all planted in rows 10in. apart and 4in. apart in the rows and 2in. deep. The smaller corms were all planted on June 3rd, 1936, but owing to dry weather the larger corms were not planted till August 7th on plot G and September 15th on plot M. The crops were generally good and were noticeably best on the heavier soil types.

Taking the small corms first, plot M contained two plots averaging 10.7 and 7.0 flowers per corm planted respectively. The former plot was also remarkable for the quality of the flowers. It was situated below the other one and so got all the soil drainage. The soil of plot M was a medium heavy loam not easy to work. Plot D, a poor stony soil in a sheltered situation, had two plots averaging 4.8 and 4.5 flowers per corm planted. Plot P, a medium light loam, easily worked and very suitable for bulb cultivation, had two plots averaging 7.2 and 4.3 flowers per corm planted. These plots suffered severely from drought in the summer, and the quality of the flowers was very poor until the early spring.

The larger grade corms were planted too late to start flowering until after Christmas. Plot G, a medium heavy loam easy to cultivate, gave a crop averaging 6.0 flowers per corm, and remarkable for its very fine quality in the spring. Plot M was in poor condition at planting time, and gave a late crop of poor quality, too few to be worth counting.

The results support the general experience that the best anemone soil is a well prepared medium heavy loam which does not suffer from drought.

HOT WATER TREATMENT OF VIOLETS

The treatment described in the last Annual Report, p. 6, was repeated on April 27th, 1937. It was unfortunately not possible to plant the runners in good soil, and only 44 out of 100 treated survived. The plants suffered considerably during the dry weather in June.

APPLE TREE BANDING TRIALS

A further trial of tree banding for the control of Apple Blossom Weevil was laid down at three centres, but no results were obtained, the reason being that the corrugated paper of which the bands were constructed was of such poor weather-resisting qualities. At the time when the trials were examined, in early December, practically all the bands at all centres had been washed off the trees by rain.

NARCISSUS LEAF DISEASE RESEARCH

Dr. P. H. Gregory has continued his investigation of the diseases of commercial flower crops in West Cornwall. He has shown that spraying narcissi with Bordeaux Mixture not only controls White Mould (*Ramularia Vallisumbrosae*) but also increases the crop of bulbs lifted. He has also studied diseases of Iris and Anemones.

NARCISSUS STRIPE

A joint scheme of investigation has been drawn up and is now being pursued in co-operation with the Botany Department, of University College, Exeter.

NARCISSUS BULB INSPECTION EXPERIMENT

This experiment, which will take three years to complete, is being carried out in co-operation with the County Council Staffs. The object is to ascertain the practical value of periodic inspections of commercial plantings and to gain as much information as possible on disease and pest incidence and control, particularly Bulb Eelworm (*Anguillulina dipsaci*). The inspections are confidential. Stocks were inspected at three centres in Devon and at three centres in Cornwall. A representative selection of varieties was included.

The results of the first season's inspections, three in number at each centre, have shown definitely that a single inspection is of no value. In practice three inspections at least are necessary. A single inspection if carefully timed in relation to district, season, and variety, might sometimes suffice, but could not be arranged in practice where visits have to be booked a few days ahead. The reason why several inspections are needed is because it has been found that a very rapid increase in eelworm is possible at a certain period, the dates of which will vary with the weather and variety. It is also essential to inspect all adjoining stocks. Arrangements have been made for the same stocks to be inspected next year, whether lifted and replanted or not, so as to follow up this season's observations and check the findings of the first season.

PUBLICATIONS

By L. N. Staniland.
"Investigations at Seale-Hayne Agricultural College of the Efficiency of Bulb Treating Baths."
The Daffodil Year Book 1937, pp. 56—60.

By L. N. Staniland and D. R. Barber.
"The Efficiency of Baths used for the Hot Water Treatment of Narcissus Bulbs."
Ministry of Agriculture Bulletin 105.

By A. Beaumont and P. H. Gregory.
"A New Leaf-Spot Disease of Gerbera."
Gardeners' Chronicle, July 10th, 1937, p. 28.

By P. H. Gregory.
"Narcissus Leaf Diseases."
The Daffodil Year Book 1937, pp. 46—52.

Notes on Pests during the Year.

The weather was cold and wet during the first half of the year under review. Insect pests were not at first plentiful, but with the advent of warm dry weather many of them became more abundant. Aphids in particular were exceptionally serious, and few plants of any kind escaped attack. Ladybirds, Hover Flies, and other checks on this pest had a bad start, and it was late in the season before their effect on aphids was at all marked.

CEREALS

Slugs were very destructive during the spring until dry weather came. Stem Eelworm attacks on oats were much below those of the previous year, both in numbers and severity. Leatherjackets and Wireworms caused the usual amount of damage, but the attacks were not exceptional in character. The principal feature of the year was the attack of Frit Fly (*Oscinis frit*) on winter wheat, which occurred in both Devon and Cornwall. Some of the more severe cases occurred after leys. A pest of interest was the Wheat Stem Sawfly (*Cephus pygmaeus*) which was responsible for almost a complete failure of wheat in South Devon.

CLOVER

Attacks by Clover Seed Weevils (*Apion spp.*) on Cornish Marl Clover in North Cornwall continue to give trouble, and fresh areas are now infected in the Wadebridge and Padstow areas. This clover is a 'single cut' variety, and does not lend itself to controlling the weevils by desiccation of larvae in a first cut in order to get a good crop of seed in the second cut. Sufficiently good results have been obtained with Derris dusting to suggest that some control may follow from this method. In trials this year where the dust was applied heavily a large percentage of the weevils was killed, and the amount of seed harvested from these areas was much increased. If the derris dust can be applied at the correct dates and in an efficient and economic manner, results of practical value may be obtained; further trials on these lines will be carried out next season.

PULSE

Beans were heavily attacked by Bean Aphis (*Aphis rumicis*), particularly the later Runner Beans. The weather was too cold for heavy attacks on Broad Beans. A slight attack of Potato Eelworm (*Heterodera schachtii*) occurred on peas near Exeter. Pea Thrips (*Frankliniella robusta*) was generally severe on peas.

POTATOES

New cases of Potato Eelworm (*Heterodera schachtii*) have occurred during the year in widely separated districts of Cornwall and Devon. Some of these cases were on allotments, but there were new cases on farms and holdings, particularly in the early potato districts of West Cornwall. Some method of preventing new areas from becoming infected is definitely wanted. A case near Bideford on investigation was found to have 202 cysts present in a 20 gram sample of soil, an exceptionally high figure.

Potato Aphids are described on p. 18; the discovery of the Violet Aphis (*Myzus ornatus*) for the first time on potatoes may be mentioned here.

Capsid Bug attacks were local, and chiefly on allotments and few were severe. *Lygus pabulinus* and *Calocoris norvegicus* were both noted.

ROOTS

Mangolds were attacked by Pygmy Mangold Beetle (*Atomaria linearis*) near Sidmouth. There was clearly a great reduction of this pest as compared with last year.

Flea Beetles (*Phyllotreta spp.*) were very troublesome on swedes, and Leatherjackets (*Tipula spp.*) caused losses to both swedes and mangolds. Bean Aphis (*Aphis rumicis*) was very prevalent on mangolds.

BRASSICAE

Flea Beetles (*Phyllotreta spp.*) were again very severe pests of Brassica crops and whole seed beds were in some instances destroyed. Cabbage Stem Flea Beetle (*Psylliodes chrysocephala*) gave far less trouble in the Truro district than during the previous year. Some bad cases of Cabbage Root Fly (*Chortophila brassicae*) were seen, but the trouble was local. In several instances trouble in broccoli was not experienced until after the plants had been set out. Cabbage caterpillars (*Pieris spp.*) were numerous, but once more rains in the autumn checked them and avoided severe losses.

Cabbage White Fly (*Aleurodes brassicae*) appears to be steadily getting worse each year, though most of the severe attacks are to be found in market gardens and allotments. Cabbage Gall Weevil (*Ceuthorrhyncus pleurostigma*) is mainly a pest in areas regularly growing large quantities of cabbage plants, infections of practically 100 per cent. being noted. The plants do not, however, appear to be seriously weakened. Slugs caused losses of cauliflower plants in North Devon. Leatherjackets were locally severe on broccoli.

OTHER VEGETABLES

Carrot Fly (*Psila rosae*) was again severe in Devon. Lettuce was attacked by Root Aphis (*Pemphigus bursarius*) in Devon. *Aphis rumicis* was common on beet in South Devon, and Spinach Beet was also attacked.

White Fly attacks on tomatoes (*Aleurodes vaporariorum*) were generally slight in South Devon despite what would seem to have been favourable conditions. Eelworm (*Heterodera marioni*) continues to occur from time to time, and can usually be traced to the buying in of plants on some previous occasion.

A few more cases of Garden Centipede (*Scutigerella immaculata*) were seen in the Plymouth district, and in one instance three plantings were necessary before establishment was effected. The centipedes were found to be congregating in large numbers beneath dropped fruit.

FRUIT

Apple Blossom Weevil (*Anthonomus pomorum*) still remains one of the most persistent pests of apple. Codlin Moth (*Cydia pomonella*) was again plentiful and seems to be extending to commercial orchards to an increasing extent. Apple Sawfly (*Hoplocampa testudinea*) has not increased greatly and is not yet, on the whole, serious in the South West. Very little trouble was experienced with Winter Moths (*Cheimatobia brumata etc.*). Wasps were very numerous indeed and caused much damage. Starlings are becoming a serious pest in Devon and cause heavy losses by damaging the fruit. Capsid Bugs (*Lygus* and *Plesiocoris*), although frequent in gardens and in some arable orchards, were by no means serious pests of common occurrence in the South West. Dock Sawfly (*Ametastegia glabrata*) occurred in a grass orchard of Cox's Orange Pippin in East Devon. Red Spider (*Oligonychus ulmi*) was very prevalent in East Devon on various top fruits. Apple aphids of all kinds were severe, the Permanent Apple Aphis (*Aphis pomi*), Rosy Apple Aphis (*Anuraphus roseus*), and Woolly Aphis (*Eriosoma lanigera*) being particularly bad. Apple Sucker (*Psylla mali*) was so numerous in South Devon where trees were not sprayed that the winged adults were literally present in clouds. A few cases of Leopard Moth Caterpillars tunnelling in the branches of apple occurred in South Devon. Brown Tail Moth caterpillars (*Euproctis chrysorrhoea*) were more plentiful than usual. Apple Leaf Skeletoniser (*Anthophila pariana*) was found in a garden near Exeter.

A number of cases of Pear Slugworm (*Eriocampa limacina*) were seen in gardens. The usual number of isolated cases of Pear Midge (*Contarinia pyrivora*) was noted, but this pest is not common. Lithiasis due to Capsid Bug attacks was found on the fruits of pear in North Cornwall. In addition to the attacks of Red Spider (*Oligonychus ulmi*) the greenhouse species (*Tetranychus telarius*) was noted on pears under glass in West Cornwall. Peach trees under glass suffered greatly from Red Spider. Leaf Curling Plum Aphis (*Anuraphis padi*) was very prevalent in Devon, and though some attacks of the Mealy Plum Aphis (*Hyalopterus arundinis*) were seen in gardens, the worst infestations were on Wild Sloe in hedges.

Raspberry Beetle (*Byturus tormentosus*) was noted at Paignton. This pest has still not established itself in the South West.

Strawberry crops were better in the South West than for several years. "Red Plant" and "Cauliflower Disease" both occurred, and the latter trouble was above the average in intensity, particularly in the Tamar Valley. Little trouble was experienced with aphis (*Capitophorus fragariae*) until the early autumn, when the dry weather broke. Red Spider (*Tetranychus telarius*) was, however, severe. Strawberry Mite (*Tarsonemus fragariae*) was not generally common and attacks were only local. Melolonthid larvae were also locally troublesome. Strawberry Blossom Weevil (*Anthonomus rubi*) gave less trouble in North Devon than usual.

FLOWERS

Bulb Eelworm (*Anguillulina dipsaci*) is still generally distributed in the flower growing districts of Devon and Cornwall. It is quite evident the hot water treatments for the control of this eelworm are proving much more efficient and the improvement of many of the baths is reducing the incidence of eelworm to a marked extent. The number of bulb baths installed has again increased, and the new baths are thoroughly up-to-date.

Bulb Fly attacks (*Merodon* and *Eumerus*) were normal in character. *Merodon* attacked Habranthus bulbs and *Eumerus* larvae were found in bulbs of Fritillaria near Honiton.

Bulb Scale Mite (*Tarsonemus approximatus* var. *narcissi*) was found in various stocks of bulbs being forced. In some cases the bulbs were locally grown,in others the bulbs came from Lincolnshire. The effects of this pest were exceptionally noticeable on

outdoor narcissus in West Cornwall, the Tamar Valley, and in South Devon. Severe stunting and twisting of the plants occurred, the varieties chiefly affected being Hospodar, Killigrew, Emperor, and Double White. The effects of the pest were confused by some growers with eelworm. Slight serration of the flower stems and leaf symptoms have been even commoner.

Tulips were heavily infested with aphids, more so than for several years. *Macrosiphum gei* and *Anuraphis tuliparum* were both noted. Larvae were found tunnelling into tulip flowers in South Devon, the larvae feeding inside the flowers. The attack was very slight and of no economic importance, but it is of interest that the fly which resulted when the larvae were bred proved to be *Opsolasia meadi*, an *Anthomyiid* previously only recorded from birds' nests.

Iris still appear to be free from attacks of eelworm in the South West, so far as can be ascertained. Iris tingitana growing in the open at Seale-Hayne College, and heavily infected with mosaic, was freely attacked by aphis (*Macrosiphum gei*). Larvae feeding in the flowers of iris from the Isles of Scilly were bred out and proved to be those of a moth *Cnephasia conspersana*.

Anemones again suffered from attacks of Cutworms (*Agrotis spp.*), the damage giving the effect of apparently bad germination. Paris Green and bran poison baits gave poor results at times, since the conditions were so dry that the cutworms remained below ground. Wireworms brought about heavy failures of corms in newly ploughed ley ground.

In common with other plants, anemones were severely infested with aphids, chiefly the Violet Aphis (*Myzus ornatus*) but *Macrosiphum gei* was also found. The aphids caused distortion of flowers and arrested their development. It was observed that double varieties, especially The Admiral, were most severely affected. Capsid Bugs (*Lygus pabulinus*) were found on anemones in Devon. So far no noticeable ill-effects have been observed and it is not anticipated that much trouble will occur, as there is only a short period at the beginning and the end of the flower season when Capsid Bugs are active, and so far the bugs have not appeared on anemones before flowering time.

Moles caused losses of anemone plants by disturbing the soil and causing lifting, and complaints by growers are increasing. Field Mice were responsible for loss of anemone flowers in several

instances. The flowers were removed and the mice only ate round the receptacle of each flower. The flowers were taken into the burrows or accumulated in heaps outside. Birds of various kinds, mostly sparrows and pheasants, disfigured flowers by removing the petals.

Violet pests were of normal occurrence on the whole, but the hot, dry summer naturally gave rise to severe Red Spider infestations (*Tetranychus telarius*). Dwarfing associated with eelworm (*Aphelenchoides olesistus*) was not as severe as in previous years, probably owing to a mild winter with little check to the plants. Isolated cases where eelworm was severe were however noted. Violet Aphis (*Myzus ornatus*) attacks were spasmodic and not generally serious. One very severe case was seen near Plymouth, where the plants were badly stunted and reduced to a ' small-leaf ' condition.

A few cases of larvae tunnelling into roots of violets were investigated near Dawlish. The attacks were comparable with those of Cabbage Root Fly on brassicae and though the larvae appeared to be closely related, the species could not be determined. Woodlice ate nearly all the petals off flowers of Parma Violets under lights at Hemyock, Devon.

Chrysanthemum Eelworm (*Aphelenchoides ritzema-bosi*) was found to be less severe than in the previous year, the drier condition of the plants probably being responsible.

Wallflowers were heavily attacked by Flea Beetles (*Phyllotreta* spp.), and some seed beds were entirely destroyed. Cabbage Root Fly (*Chortophila brassicae*) was again noted.

Polyanthus were heavily infested with Red Spider (*Tetranychus telarius*), but mostly recovered with the advent of rain. The folly of growing polyanthus and violets close together was noted in this connection in several instances.

Dwarfing of polyanthus associated with eelworm (*Aphelenchoides olesistus*) has increased in South Devon. Dwarfing was also noted in Primula Wilsoni, P. beesiana, and P. pulverulenta, but of particular interest was the infection of Bulb Eelworm (*Anguillulina dipsaci*) which was also present, and which ruined many plants in East Devon. An experiment is in progress to determine whether the eelworm involved is of a narcissus strain or not. Dwarfing occurred in Auricula, eelworm being present in South Devon.

Gerbera (hybrids of G. jamesonii) were attacked by Capsid Bugs (*Lygus pabulinus*) near Plymouth, and here definite injury, largely petal distortion and petal stunting, took place. Capsid Bugs may be expected to become important should the cultivation of Gerbera be extended. Bean aphis (*Aphis rumicis* and *Macrosiphum gei*) were both noted on Gerbera. Bean Aphis was also found attacking Calendula and Anthemis in Devon.

Dwarfing without the presence of eelworm was found in Erigeron and Cyclamen. The problem of dwarfing in various plants is dealt with on p. 13.

MISCELLANEOUS

Grain Weevil (*Calandra granaria*) was found in enormous numbers in a grain store near Plymouth. Maize and oats were heavily infested. The original infection came with maize bought locally.

Maidenhair Fern was injured by the larvae of the Vine Weevil in North Devon. Bean Aphis attacked Elder in South Devon. Siberian Crab was infested with Permanent Apple Aphis (*A. pomi*). Young birch trees in a nursery in South Devon were defoliated by the larvae of a sawfly (*Coresus septentrionalis*). Hawthorn was defoliated by caterpillars of the Small Ermine Moth (*Hyponomeuta padellus*) near Plymouth. Large galls were produced by the aphis (*Adelges piceae*) on Silver Fir near Exeter and at Exmouth. An attack of Woolly Aphis (*Eriosoma lanigera*) was noted on Cotoneaster at Exeter.

Cecidomyiid larvae (*Mitodiplosis spp.*) were feeding in large numbers on Mint Rust sent from West Cornwall.

Notes on 'Dwarfing Diseases'

OF PLANTS WITH SPECIAL REFERENCE TO POLYANTHUS AND CYCLAMEN

The well known diseases of strawberries familiar to growers under the names of 'red plant' and 'cauliflower' diseases may be properly included under the heading of 'dwarfing diseases.' Whilst textbooks give the cause of these conditions of the strawberry as being due to attacks by an eelworm (*Aphelenchoides fragariae*), it is now realized that the evidence for this statement is purely circumstantial, and that eelworm may only be of secondary importance.

In the Tenth Annual Report of this department appeared an account of a similar condition obtaining in violets and in the case of this plant another eelworm (*Aphelenchoides olesistus*) was similarly associated with plants exhibiting the dwarfing symptoms. In the Twelfth Report of the department appears a record and description of dwarfing symptoms appearing in plants of the Primula (Jewel) in South Devon. The same eelworm (*A. olesistus*) was found to be associated with the condition of these primulas.

DWARFING OF POLYANTHUS

In the same account appeared a statement relating to dwarfing of polyanthus. The statement was as follows: "Symptoms similar to those found in the Primula (Jewel) have been found in Polyanthus, but the red colouration has not been observed. So far no eelworm has been detected in Polyanthus, but in view of the importance of this plant as a commercial flower crop, a careful watch for such symptoms will be made." This account was written as the result of observations made during the year 1935. During 1936, polyanthus were examined in many districts of Devon and Cornwall, but only one further case was discovered. This was a small batch of plants near Newton Abbot. Typical dwarfing symptoms were present, but the main point of interest was that eelworms, of the species *Aphelenchoides olesistus*, were found in large numbers feeding on the external surface as is the case with those found on the violet and strawberry.

During 1937 polyanthus plants have again been carefully examined, and the dwarfed condition has been found in a wide range of districts in Devon and Cornwall. This suggests a true increase in the incidence of the trouble, in view of the careful search for it during the previous year.

a.

b.

FIG. 1.

(a). Crown of two year old plant of polyanthus to show typical 'dwarfing' symptoms. (About twice natural size).

(b). Single leaf from (a). still further enlarged, to show reduction in size of leaf blade.

The sketch of a typical affected plant (Fig. 1a) will show clearly the symptoms. The leaves become successively smaller as growth proceeds. The arrow points to a crown affected the previous year and now dead. The leaf blades become smaller and smaller in proportion to the mid-ribs (Fig. 1b), and in the final stages of the disease the leaves consist of little but mid-rib. The leaves also have a marked tendency, in severe cases, to bend outwards and downwards in a manner which is very typical. Affected plants usually have a well developed and apparently healthy root system. The disease is to be found in one year plants, but is more frequently met with in two or three year old plants. In all cases the affected plants fail to produce any blossom, though healthy crowns may be present on plants in which the remaining crowns are all affected.

The eelworm (*Aphelenchoides olesistus*) is not always associated with the dwarfed condition of the plants, and on a number of occasions severely affected plants have been found to be quite free from eelworm.

Later in this article it is made clear that the exact cause, or causes, of dwarfing of various plants, must be regarded as undiscovered.

The only advice which can be given to growers at this stage is that affected plants should be lifted and destroyed, and that care be taken that no affected plants are 'split up' for propagation purposes. Though there is no evidence that soil remains infected, it is probably wise not to grow two crops of polyanthus successively on the same ground.

DWARFING OF CYCLAMEN

Early in the year a single specimen of Cyclamen was received which exhibited marked stunting, together with tapering of the leaf stalks and absence of flowers. A careful examination failed to discover any eelworms, mites, or other organisms which might be responsible. Cyclamens have been examined in various parts of Devon, and three cases, involving some hundreds of plants, were found. From the symptoms, the trouble appears to be comparable with dwarfing of strawberry ('red plant'), violet, and polyanthus. In this connection it is of especial interest that no organisms, such as eelworms or mites, have been discovered in cases of cyclamen dwarfing. Fig. 2 illustrates a striking example of this dwarfing. It should again be noted that leaf distortion occurs, there is also the same tendency for the leaf stalks to bend outwards and downwards, and in severe cases (even more advanced than that illustrated) the leaf blade disappears entirely and only a short tapering leaf stalk remains. The root systems are good and apparently healthy.

No question of vine weevil arose in two of the cases examined; in the third case vine weevil larvae had caused additional injury, which had clearly aggravated the trouble. It is also of interest that dwarfing was also observed in small plants raised from seed. This might suggest that the trouble was carried in the seed, or that seedlings were growing in infected soil, but there is insufficient information to allow of a definite conclusion. Control, in the present state of knowledge, can only consist of destruction of affected plants and the taking of all possible precautions to avoid the use of any soil which might carry infection.

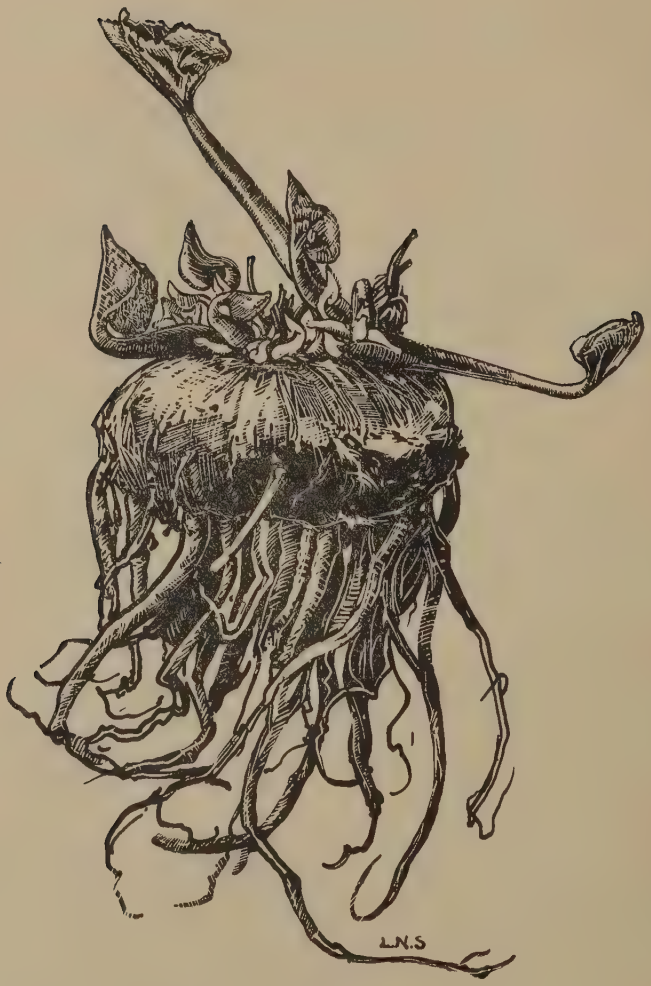


FIG. 2.
Cyclamen to show typical dwarfing symptoms.
(About natural size).

Dwarfing diseases of plants are clearly a somewhat complicated problem. Much information has been collected, and the problem is receiving much attention. Miss M. S. Lacey, of the Department of Bacteriology, Imperial College of Science, finds that bacteria are associated in many instances with the dwarfed condition of plants, though the exact part played by the bacteria is not as yet fully understood. Dr. T. Goodey, of the Institute of Plant Parasitology, is closely concerned with the work, particularly in those cases where eelworms have been found to be present.

It is not considered that any useful purposes will be served in discussing the general problem in any greater detail at this stage, but a list of plants in which definite dwarfing symptoms have been found in the counties of Devon and Cornwall is likely to be of interest. Other plants have been reported to be suffering from dwarfing in other counties.

The following is a list of the plants found to be affected in Devon and Cornwall, together with the notes on the presence of eelworms :—

Anemone	No eelworm present.
Auricula	Eelworm (*Aphelenchoides olesistus*) present.
Broccoli	No eelworm present.
Bulbous buttercups	No eelworm present.
Cyclamen	No eelworm present.
Erigeron	No eelworm present.
Lettuce	No eelworm present.
Pansy	Eelworm (*A. olesistus*) frequently present.
Polyanthus	Eelworm (*A. olesistus*) frequently present.
Primula Jewel	Eelworm (*A. olesistus*) present.
Primula Beesiana	Eelworm (*A. olesistus*) present.
Primula pulverulenta	Eelworm (*A. olesistus*) present.
Primula Wilsoni	Eelworm (*A. olesistus*) present.
Scabious (Caucasian)	Dwarfing symptoms in flowers. Eelworm (*A. parietinus*) present. This species of eelworm is considered to be entirely saprophytic.
Strawberry 'Red Plant' and 'Cauliflower' diseases	Eelworm (*A. fragariae*) present.
Violet	Eelworm (*A. olesistus*) present.

It has been observed, in all those plants in the list given above which develop more than one crown, that apparently perfectly healthy crowns can be present on plants otherwise seriously affected with dwarfing.

Potato Aphid Survey of Devon and Cornwall.

At the suggestion of Mr. J. C. F. Fryer, of the Ministry of Agriculture, a survey of Potato Aphids in Devon and Cornwall was commenced during the year, the object of the survey being to ascertain which areas, if any, of the two counties were likely to be suitable for seed potato production.

The survey was carried out by exactly the same methods as those devised by the late Dr. Maldwyn Davies, of Bangor. It was not found possible, in the rather limited period of the year when significant counts could be made (second week in June to third week in July), to cover as many districts as was desirable; the survey will, however, be continued next year.

Counts of aphids of the species *Myzus persicae*, sub-divided into winged, apterous, and parasitised individuals, have been made at 12 centres in Cornwall and at 15 centres in Devon, involving 57 visits in all during the period May 21st–August 19th, 1937. In addition to counts of *M. persicae*, observations have also been made on other Aphid species present. The centres have been selected so that they are well distributed over the two counties, but there has been a preponderance of centres in the north of each county, the reason being that a likely development from the investigation would be the production of seed-potatoes on farms in the north of the counties for planting by the early potato growers in the south of the counties. This possibility is supported by the first season's work.

Records were kept of weather conditions, particularly humidity and wind, and also of altitude and other data. Briefly the results of the season's work are as follows:—

1. Dr. Maldwyn Davies' work in North Wales seems to apply equally in the South West, in which areas it has also been found that areas of low infestation with *M. persicae* are not necessarily at a high altitude, e.g., Braunton Great Field in North Devon gave low counts, and is practically at sea level, but being next to the sea is windy and humid. At the same time centres at higher altitudes tend to be best because they are exposed and are particularly windy and humid.

2. The northern parts of the counties have yielded the more suitable centres, both from the point of view of climatic conditions and isolation from concentrated potato growing areas.

3. Most of Devon and Cornwall is likely to be quite favourable for once and twice saving of seed, and the work strongly suggests that there are a large number of areas which should be quite suitable for extended saving of seed, i.e., seed potato production in its fullest sense.

4. A few centres have been found in each county free from any species of aphid; some centres have been found in each county free from *M. persicae*. The majority of the centres have given counts of *M. persicae* well below Mr. Davies' maximum allowable number (20 aphids per random sample of 100 leaves). A few centres have given larger counts, and situation and weather data seem to explain these cases satisfactorily.

5. Counts have been made a number of times at certain centres, and the period of maximum infestation of *M. persicae* has been determined as about the middle of July.

6. Other species of aphid noted on potato include *Macrosiphum gei*, *Myzus pseudosolani*, *Aphis rumicis*, *Aphis rhamni*, and *Myzus ornatus*.

Myzus ornatus is a pest of violets, anemones, and other plants, and its presence on potatoes has not previously been recorded. This species, however, seems rapidly to be adapting itself to fresh hosts and to be spreading throughout England. It is, at present, not known whether or not *M. ornatus* is capable of transmitting virus diseases of the potato, and it is to be hoped that this will not prove to be the case. If *M. ornatus* were proved to be the vector it might complicate the problem of seed production in the South West and possibly elsewhere, since evidence has already been obtained that this species does not appear to be limited by high humidity and wind, as is the case with *M. persicae*. Arrangements have been made with Dr. K. M. Smith, of the Plant Breeding Station, Cambridge, to test *Myzus ornatus* as a vector of potato virus.

So far then as one season's observations go, it may be concluded that there are many districts in Devon and Cornwall where the aphis population on potatoes is too low to carry virus diseases, and that such districts will probably prove suitable for seed potato production.

Only the continuance of the survey for several years will show whether such a year as that which has passed may be regarded as normal or otherwise. It is true that aphids as a class have been serious pests in the South West during this period, and attacks of some potato species other than *M. persicae* were very heavy, but this does not necessarily mean that a species such as *M. persicae* will necessarily also be abundant. It is also of interest that weather conditions during the past season in the South West have been favourable to the migration of *M. persicae*, rather than otherwise.

Hot Water Treatment of Potatoes.

Experiments in the hot water treatment of potatoes, variety Majestic, have been described in previous Annual Reports (10th, 12th, 13th). This year several varieties were tested, viz, Arran Pilot, Doon Star, Gladstone, Golden Wonder, and Majestic. All the treatments were carried out in a small electrically heated bath for one hour at 110° F, each lot taking 1 hour to reach the steady temperature.

The dates of treatment were as follows :—

Arran Pilot	10 February 1937.
Golden Wonder	11 February.
Doon Star	12 February.
Gladstone	18 February.
Majestic (saved seed)	4 February.
Ditto	8 February.
Majestic (Scotch seed)	9 February.

All the potatoes were afterwards stored in sprouting trays kept in the same shed. In every variety the sprouting of the hot water treated seed was backward compared with the untreated. The retarding was most severe in the variety Arran Pilot. The growth through the soil was, as a result, equally seriously retarded. In Arran Pilot the shoots from the treated tubers were over a month later in coming through the soil. Other varieties were retarded about a fortnight, except Majestic, with which the interval was only a week.

Dry Rot was present in a number of untreated tubers, viz. Arran Pilot 6 out of 80, Gladstone 2 out of 50, Doon Star 1 out of 41, Golden Wonder 1 out of 200, Majestic 1 out of 150. There was none in the hot water treated tubers.

Potato Blight appeared on July 20 on one leaf of Golden Wonder, which was removed. A few lesions were seen on July 21 on Majestic, but there was no increase on any variety until the end of August, and the epidemic was never serious.

The resulting crop is summarised in the following table :—

Variety	No. planted	Date planted	Date lifted	Crop per tuber planted	
				Ware	Total
Arran Pilot					
Untreated	75	April 9	July 1	0.46 lb.	0.60 lb
Treated	36	April 9	Sept. 16	0.10	0.15
Doon Star					
Untreated	40	April 9	Sept. 6	2.10	2.27
Treated	18	April 9	Sept. 6	0.74	1.10
Gladstone					
Untreated	48	April 21	Sept. 3	1.18	1.44
Treated	18	April 21	Sept. 3	0.17	0.30
Golden Wonder					
Untreated	196	April 10	Oct. 11-19	1.64	2.18
Treated	41	April 10	Oct. 18	1.20	1.80
Majestic (Saved Seed)					
Untreated	102	May 1	Oct. 26	0.79	1.27
Treated 4 Feb.	23	May 1	Oct. 26	0.36	0.71
Treated 8 Feb.	21	May 1	Oct. 26	0.64	1.00
Majestic (Scotch Seed)					
Untreated	147	April 30	Oct. 21	1.06	1.80
Treated	36	April 30	Oct. 21	0.35	0.79

It will be observed that the crop reduction was severe with Arran Pilot and Gladstone and bad with Doon Star, but not so serious with Majestic and Golden Wonder. There was a good deal of variation between the individual rows of most of the varieties so that the experimental error was large, but it was evident that the retarded growth from the hot water treatment resulted in a reduced crop. Further, the early varieties suffered more severely than the main crop varieties. The yields were low owing to the dry summer.

The date of treatment was somewhat earlier than last year's trials, but probably not early enough, the successful results of 1933 having followed treatment on January 28. In next year's Report it is hoped to give an account of trials of treatments carried out at different dates from December to February.

Potato Blight and the Weather.

During the past season continuous records of both relative humidity and temperature have been obtained from instruments situated in the potato plots at Seale-Hayne. From these records the following data have been obtained :—

(1) Days with minimum temperature 50° F or above :
May : 23, 24, 26.
June : 5, 6, 7, 9, 11 to 15, 22, 23, 24, 27.
July : 1 to 4, 6, 7, 9 to 23, 25 to 31.
August : 1, 2, 3, 5 to 20, 22, 23, 26, 27, 30, 31.

(2) Days with relative humidity not falling below 75%.
May : 8, 9, 20, 22, 23.
June : —
July : 11, 18.
August : —

The data obtained at the College meteorological station correspond closely with the above. They show a few more days with the minimum temperature up to 50° F, as would be expected from the situation of the station higher up the hill slope than the potato plots.

The outstanding feature of the season was the remarkably low relative humidity, much the smallest since these observations began in 1929.

Taking the two sets of dates together the only favourable Blight period was May 23. No Blight followed, thus confirming the experience of previous years that early favourable periods are not as a rule followed by outbreaks in Devon. In West Cornwall Blight began about the 20th ; this was probably connected with the favourable humidity period May 8, 9. This is confirmed by the fact that the minimum temperatures at Gulval, in the middle of the affected district, were above 50° F on May 6, 7, 8, 9.

Blight did not appear until July 20 in the potato plots, where the recording instruments were situated, and the amount of the disease was very small. This outbreak probably followed from the high humidity of July 11. Humidity was high on July 12 also except for about an hour at midday, so that there was almost the usual two day period of high humidity.

The occurrence of Blight in June in a few localities in South Devon may be due to the local weather having been favourable but no data are available to verify this. The occurrence of Blight on Sharpe's Express at Rattery, near South Brent, early in July was surprising, as the field was about 500 ft. above sea level, but the exceptionally warm June may have given suitable temperature conditions, and days of high humidity are more likely near Dartmoor than at Newton Abbot.

The value of the above data for forecasting Blight attacks was therefore less in 1937 than in previous seasons. It is probable that in a dry year the incidence of Blight is affected more by slight fluctuations in local weather conditions amongst the plants themselves, and these are impossible to estimate.

The dryness of the year is shown by the following table, which shows the number of days relative humidity over 75%.

	1937	1936	1935	1934
May	5	4	8	3
June	0	5	7	3
July	2	13	1	0
August	0	3	4	7

The Dates of Hot Water Treatment of Narcissus Bulbs.

One of the principal drawbacks of the hot water treatment method of controlling eelworm in Narcissus bulbs is the great danger of seriously reducing the marketable crop of flowers in the season following treatment. Growers in fact have tended to regard this loss as unavoidable, and have been loath to treat their bulbs in hot water as promptly as is necessary for the satisfactory control of the eelworm pest. It has been known, however, that some varieties can sometimes be treated without appreciable loss. Hot water treatment data have now been amassed over a number of seasons, and have been collected from various growers as well as from experiments at Seale-Hayne College, and other centres. The present article is an attempt to summarise these data in a form of practical value to the grower.

The damage sustained by bulbs in the hot water bath depends on three factors, viz: (1) length of the time of treatment, (2) temperature, and (3) date of treatment.

When bulbs are treated for the control of Bulb Flies the period of immersion is only one hour, and the flowers are rarely damaged at all by this treatment. Many small bulbs could be treated for shorter periods than three hours with complete eelworm control and with considerably less flower damage (cf L. N. Staniland, "The Treatment of Narcissus Bulbs with Hot Water," Journal of the Ministry of Agriculture, vol. 40, 1933, pp 343-355). In order not to make the subject too complex, however, only the standard period of three hours is being investigated in the present article.

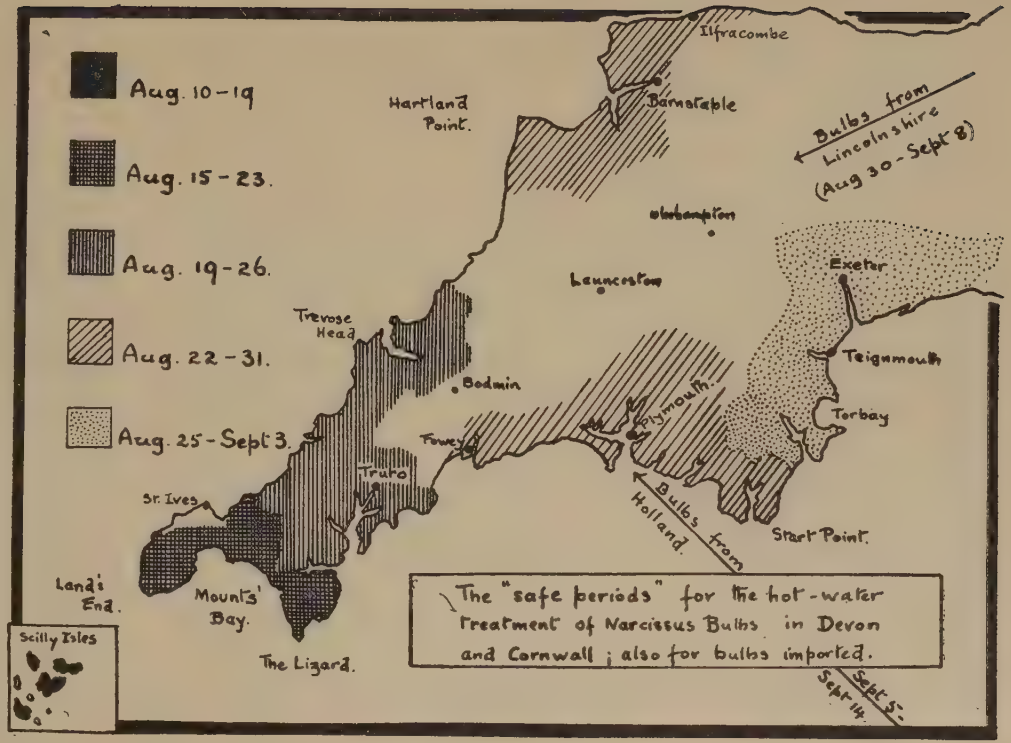
The accurate regulation of temperature is a matter of great importance in bulb treatment, as the danger of damage increases rapidly with each degree rise in temperature above 110° F. The recent discoveries (described in the Twelfth Annual Report and Bulletin 105 of the Ministry of Agriculture) that many commercial bulb baths give fluctuating temperatures not always corresponding with the thermometer reading, have provided an explanation of many of the cases of flower damage experienced in practice. When bulbs attain a temperature of 115° F., despite a thermometer reading of 110° as has actually been measured in some baths, it is not surprising that serious flower damage follows. In the present article the observations and recommenda-

tions apply only to a correctly working bath, and experiences widely different from those here described may be taken as presumptive evidence that the bath in use is not working properly.

The nature and amount of flower damage varies considerably according to the date of treatment. Generally speaking, treatments early in the season, say in July, cause severe splitting of the trumpet or corona and of the perianth segments, but the size of the crop is not reduced. Treatments late in the season, say in September and October, lead to a reduced crop, most of the bulbs becoming blind (i.e. showing no buds) or producing blind buds. The flowers that are produced may be somewhat smaller than normal and of less substance and the perianth segments very often have their edges slightly chipped. Nevertheless they are marketable, whereas the damaged ones from the early treatments are not. In between the two periods is the happy medium, or "safe period," when no damage at all is sustained. It is of course the object of the flower grower to carry out all his treatments during this period. There are unfortunately two great practical difficulties in the way of this, (1) the amount to be treated may be too great for the available period, which is generally only about a fortnight, (2) the necessity of planting immediately after treatment where adequate trays and storage space are not available. For these reasons the tendency in practice has been to continue the treatments rather late. Apart from the question of flower damage, this late treatment is undesirable, as it leads to foliage injury (not generally serious) and injury to rooting, which may seriously weaken growth in the first season. It is suggested, therefore, that the grower make an effort to treat his valuable flowering stocks during the safe period and treat chips and less valuable flowering bulbs *before* the safe period.

The dates of the safe period depend not only on the variety but also on the district in which the bulbs are grown. In an early district the period is earlier than in a later district. For example, a grower in South Devon could treat his own bulbs at the end of August, but any bulbs he buys from Scilly should be treated earlier while purchases from Holland must be treated later. The correct dates for each bulb growing district are shown on the map on p. 27, and may be summarised as follows :—

Scilly	Aug. 10—19.
Penzance area	,, 15—23.
Truro area	,, 19—26.
Tamar Valley	,, 22—31.
Devon	Aug. 25—Sept. 3.
Lincolnshire	,, 30—Sept. 8.
Holland	Sept. 5—Sept. 14.


Aug. 10 – 19
Aug. 15 – 23.
Aug. 19 – 26.
Aug. 22 – 31.
Aug. 25 – Sept 3.
Ilfracombe
Barnstaple
Hartland Point.
Bulbs from Lincolnshire (Aug 30 – Sept 8)
Okehampton
Launceston
Exeter
Teignmouth
Torbay
Trevose Head
Bodmin
Truro
Fowey
Plymouth
Bulbs from Holland.
Start Point
St. Ives
Land's End.
Mounts' Bay.
The Lizard.
Scilly Isles
The "safe periods" for the hot-water treatment of Narcissus Bulbs in Devon and Cornwall; also for bulbs imported.
Sept 5 – Sept 14.

The safe period probably varies somewhat in different seasons, e.g. one would expect it to be earlier following an early flower season, but experience shows that the variations are so small that they need not be considered.

The facts so far briefly summarised will be better understood if a short account is given of what is going on inside the bulb during the summer months. It is well known that a flower bud can be seen inside a bulb at the time of lifting, and that this will be the flower which appears above ground the following spring. This flower bud starts to form in May, and its differentiation goes on during May, June, and July, by which time the different parts of the flower, perianth segments, stamens, corona, etc., have all been formed. The corona is one of the last to be laid down and the early hot water treatments mentioned above, being carried out before it is quite complete, produce the severe splitting already mentioned. During this period of flower differentiation, the bulb requires to be kept at a temperature of 62-68° F., and any marked deviation whether due to hot water or to cold will give rise to flower damage. A bulb is not, therefore, dormant in the full sense of the word at the time of lifting. This dormancy period begins only when flower differentiation is complete, and this coincides with the safe period of hot water treatment when the bulb is least sensitive to damage.

Soon afterwards the flower bud begins to elongate inside the bulb, gradually moving up until it is in the neck of the bulb. At the same time the scales that become the enclosing leaves are also growing and the new roots are forming. In this period the roots and the flower bud are very sensitive and easily injured. The bud is indeed often killed outright, and when bulbs that have been rendered blind by hot water treatment are cut open the shrivelled brown remains of the dead bud can usually be seen.

In the next part of this article the behaviour in relation to hot water treatment of the most important varieties arranged in the order of the R.H.S. classification will now be considered.

Class 1a—Yellow Trumpets

The old varieties Golden Spur, Henry Irving, and Obvallaris all have a long " safe period," that is to say, they may be treated a few days before the dates given on the map and also for a week or more later. In fact, treatments right through September have given good quality flowers with no serious reduction of crop. October treatments cause injury to the roots, resulting in paler

foliage and short flower stalks. Henry Irving has a reputation amongst many growers for suffering severely after hot water treatment. The reason for this is incorrect after-treatment, this variety being very sensitive to unsuitable storage after hot water treatment (see p. 33).

The treatment of King Alfred must, on the other hand, be rigidly confined to the "safe period" as later treatments produce severe reduction of the flower crop. Other varieties behaving in a similar manner are M. J. Berkeley, Monarch, and Tresserve. Emperor and Van Waveren's Giant occupy an intermediate position: they must not be treated earlier than the safe period but can be treated with little loss for two or three weeks later.

Class 1b—White Trumpets

These varieties are mostly very sensitive to hot water treatment, and should not be treated outside the "safe period."

Class 1c—Bicolor Trumpets

In contrast to the previous group, most of these varieties have a long "safe period" comparable with that of Golden Spur. Empress, Glory of Sassenheim, Grandis, Horsfieldii, Princeps, Spring Glory, all behave in this way. Victoria is a marked exception, and its treatment should be confined to the standard safe period. This variety also requires very careful handling after treatment.

Class 2—Incomparabilis

These varieties are not specially sensitive but the cup is readily split by too early treatment (e.g. in Sir Watkin). The best results are given by Helios and Croesus. Sir Watkin, Fortune, Great Warley, and Whitewell may also be treated somewhat later than the "safe period." Bernardino, Hospodar, Lucifer, Macebearer, and Princess Victoria are apt to give a much reduced crop from late treatment.

Class 3—Barrii

Certain varieties of this group give the best results of all from hot water treatment. They show a long safe period and late treatments not only give good crops but also often earlier flowering than untreated bulbs. The best example of this is Sunrise, flowers from which have been picked as much as ten days earlier following September treatments. Bath's Flame and Brilliancy behave in a similar way, and Firetail and Barrii Conspicuus give almost as good results as a rule. The small bulbed white varieties such as

Fair Maiden and Seagull, show crop reduction following late treatments, and this is also shown to some extent by Red Beacon and Lady Moore.

Class 4—Leedsii

The large cupped varieties (4a) stand treatment well, but the small cupped varieties such as White Lady (4b) are very liable to damage from three hours hot water treatment. In the first group Cicely and Crystal Queen give the best results: Empire, Kingdom, Lord Kitchener, Osprey, give greater crop reduction following later treatments. In the second group serious crop reduction is characteristic of Katherine Spurrell, Lavender, Mrs. Langtry, Queen of the North, White City, and White Lady; September treatments often result in no flowers at all. It is probable that a shorter period than three hours will give better results and still control eelworm in these small bulbed varieties, but no special investigation has been made.

Class 7—Jonquils

This group gives excellent results from hot water treatment, but should be treated during the standard period to give a full crop.

Class 8—Poetaz

This group is generally sensitive to late hot water treatment but treatment during the safe period gives good results. Late treatments cause severe crop reduction and it is better to treat somewhat before the safe period than later. Elvira, Glorious and Laurens Koster give the best results. Medusa and Scarlet Gem are sometimes badly damaged.

Class 9—Polyanthus

This is the most difficult group of all in our experience. Severe flower damage or crop reduction occurs at all dates, but a few cases of satisfactory results have followed treatments during the safe period. Mr. G. W. Gibson obtains the best results in Scilly from treatments early in July. As the leaves keep green much longer on the mainland during the summer, such an early date is hardly practicable outside Scilly.

Class 9—Poeticus

The Poet Narcissi differ fundamentally from daffodils in being continuously rooting, that is to say, the new roots start into growth again in a very short time after the old ones have died off. Rooting injury is therefore possible at almost any date, but

it is fortunately rarely serious. The flowers do not suffer as much as might be expected. Slight chipping of the perianth segments is commoner than in the other groups, but excellent results follow treatment in the safe period with most varieties, and flowering generally starts slightly earlier. Ornatus, Horace, Kestrel, Snow King, Sarchedon, Sonata, Thetis, and Dante have all given good results. Rather more sensitive varieties in which the crop may be reduced include Cassandra, Glory of Lisse, Poetarum, Praecox, and Storeen. Finally the varieties Ornatus Maximus and Poeticus Recurvus are so exceedingly sensitive that severe crop reduction follows at any date of treatment. The only solution of the problem here is to adopt a short time of treatment. The period of ¾-hour has been shown to be sufficient to kill eelworm in Ornatus Maximus in an efficient bath and to produce very little flower damage (see Staniland's paper quoted above).

Experiments with Poeticus Recurvus and Horace in 1932-33 may be cited as showing that the best results are obtained by treatments in the safe period.

Poeticus Recurvus

Date of treatment	Flower crop per 100 DN	Blind buds per 100 DN
Aug. 16th, 1932	52	5
23rd	145	2
23rd	108	0
30th	138	4
Sept. 28th	65	53
28th	79	31

Horace

Date of Treatment	Comparative Flower crops taking Sept. 2 as 100	Flower Damage
Aug. 12th, 1932	100	Perianth badly chipped
19th	120	Perianth slightly chipped
Sept. 2nd	100	None
Oct. 5th	0	

Class 10—Doubles

This is a mixed group including varieties related more closely to preceding groups than to each other. Among the Double Trumpets, Double Van Sion behaves much the same as Golden Spur with regard to hot water treatment, and Holland's Glory is similar to Emperor. Among the Double Incomparabilis, Orange Phoenix, Inglescombe, and Twink give satisfactory results.

Cheerfulness is a Double Poetaz, and behaves like that group. Double White resembles Poeticus Recurvus in its extreme sensitiveness and as it usually forms a good percentage of blind buds even without treatment, damage due to hot water cannot be assessed unless untreated plots are available for observation alongside. This was carried out in an experiment in 1930-1931, and the results show the harmful effect of hot water treatment.

Date of Treatment	Flower Crop per 100 bulbs	Blind buds per 100 bulbs
Sept. 5th, 1930	37	110
12th	87	69
19th	0	79
Untreated	129	30

The Handling of Bulbs after Hot Water Treatment.

We have seen from the previous article that flower damage and growth in the season following hot water treatment may be considerably influenced by the conditions in which the bulbs are kept between the date of treatment and the date of planting. Some observations on this subject may therefore be of value.

1. Trays or Sacks ?

The use of trays is recommended for two reasons, (1) the bulbs lose their heat more slowly in sacks, so that in effect the heat treatment is prolonged with consequently greater liability to flower damage, (2) the bulbs dry much less quickly and bulb rots due to fungi have therefore more favourable conditions for development. The latter can be reduced by the use of fungicides in the hot water bath. Bulbs are often dried by spreading out on a clean floor or on dry soil in the open. The drying is, however, more efficient in trays in a well ventilated store which take less floor space and permit of the minimum possible amount of handling of the bulbs. This is an important point, as it saves labour and reduces the chances of bulb injury. To expose the bulbs out of doors is bad, as they are at the mercy of the weather, and there is a grave danger of attack by Narcissus Fly (*Eumerus*), while the chances of recontamination with eelworm may also be greater.

2. Rapid Cooling

While opinion generally has favoured a slow cooling of bulbs, some growers have, however, immersed bulbs in cold water immediately after treatment, presumably with the idea of reducing the heating period. Some experiments were carried out at Seale-Hayne in 1931 to test this. The varieties used were King Alfred, M. J. Berkeley, Weardale Perfection, and Golden Spur, and one half of each treated lot was cooled rapidly under the tap in the laboratory.

Date	Cooling	Bulbs Planted	Flower Crop	Blind Buds	Damaged Flowers
Golden Spur					
Oct. 2 and 3	..... Rapid	83 rounds	11	3	0
	.....	37 DN	11	1	0
	Normal	86 rounds	16	0	0
		36 DN	14	0	0
King Alfred					
Aug. 27	..... Rapid	40 mixed	31	0	11
and 28	..... Normal	44 ,,	26	0	2
Sept. 20	..... Rapid	12 DN	19	1	1
and 21	.....	18 rounds	10	0	0
	Normal	30 rounds	18	0	0
M. J. Berkeley					
Aug. 26	..... Rapid	32 rounds	2	2	11
		25 DN	21	0	9
	Normal	30 rounds	6	0	2
		21 DN	19	0	2
Sept. 20	..... Rapid	15 DN	12	0	4
	Normal	32 rounds	6	5	3
		19 DN	12	3	4
Weardale Perfection					
Sept. 21	..... Rapid	16 DN	28	0	0
	Normal	24 DN	50	0	0

The table of results shows that there is no difference between the rapid and normal cooling after the late treatments, but after the early treatment there was rather more damage to the flowers from the rapidly cooled bulbs. The damage was not very serious, being confined to the edge of the corona. We should expect on theoretical grounds that early treatments might require more careful cooling as we have seen in the previous article that temperature fluctuations affect flower formation. A striking example of this is shown by the effect of immersing bulbs in very cold water *at the time of lifting*, the resulting flower damage is exceedingly severe, resembling that from too early hot water treatment.

The experience of a grower in 1936 may be an example of the damage resulting from rapid cooling. About a ton of Sir Watkin bulbs were hot water treated at Penzance on 22 August, 1935, and were sent in an open lorry to the grower near Falmouth. The following year the latter was able to market only 26 third grade boxes owing to flower damage, but bulbs treated at the same time and planted in Penzance near the treating plant showed no flower damage at all. The only explanation that could be given was that damage had been done by the cooling and perhaps also the shaking during the journey in the lorry. It is an unfortunate necessity for many growers to send their bulbs away for hot water treatment, and great care must be exercised to see that they are not injured during transport.

3. Wet or Dry Planting.

The practice of planting bulbs in a wet state very soon after they have been hot water treated has the great advantage of saving storage accommodation. In many cases depending chiefly on weather conditions, no injury to growth will follow, but very frequently there is damage to rooting and sometimes even extensive bulb decay. The varieties Henry Irving and Victoria are especially liable to injury from wet planting, and damage is generally visible in Emperor though rarely so severe. Where wet planting cannot be avoided it is recommended that the bulbs be dipped in a fungicide if this has not already been used in the bath.

Notes on Fungal Diseases during the Year.

Excessive rain in the winter delayed farm operations, and was favourable to the diseases of early flower crops. Later the weather was warm and dry, and nearly all diseases were below normal.

RAINFALL AT SEALE-HAYNE COLLEGE, 1937

February	7.39 in.	June	1.22 in.
March	6.01	July	0.72
April	3.61	August	1.70
May	2.98	September	2.14

CEREALS

Rusts were insignificant on most crops. Crown Rust was fairly plentiful on some late well-grown crops of Oats without causing any damage.

Smuts were on many farms above normal. In one field of oats in South Devon the infection of Loose Smut was estimated at 10 per cent., and a sample of wheat very badly contaminated with Bunt was received from near Crediton. Loose Smut occurred on Victor wheat near Newton Abbot. Covered Smut of Barley was common in Cornwall. There were a few cases of Oats Leaf Spot (*Helminthosporium avenae*) in North and West Devon.

The term Whiteheads is loosely used for a variety of wheat troubles, most of which are probably physiological. There was no definite case of *Ophiobolus graminis* but damage was suffered in one case due to *Cercosporella herpotrichoides*, and this was probably quite frequent in Devon.

ROOTS

Mangold Black Leg was scarce in most districts, but was commoner than usual on some farms notably near Okehampton. Although common in North Devon, the damage was slight; specimens from Bishopstawton showed both *Phoma Betae* and *Pythium De Baryanum*. There was occasional slight damage in South Devon, seedlings from one case at South Pool showed only the latter fungus. In the Okehampton case in fields which had never been limed the chief fungus developing on the seedlings was *Fusarium* sp. but there was also a little *Pythium* but no *Phoma Betae*. Heart Rot was not observed, and Rust was slight.

On Swedes and Turnips, Finger and Toe was below normal, and Bacterial Rot and Dry Rot were not observed. Mildew was frequent at the end of the summer, but the damage was slight. Several cases of Brown Heart were reported in both Devon and Cornwall. The disease is generally noticed when the roots are being cut up for human consumption. It has probably been present for many years, and specimens were collected and preserved in South Devon in January, 1931, though not identified at the time.

POTATOES

The first outbreak was at Penzance on May 20th, and it looked as if there would be a serious epidemic, but dry weather during June kept it in check. The disease behaved similarly in Scilly. The main epidemic started in sporadic fashion. June 22 was the first date, near Kingsbridge in South Devon, and at Croyde in North Devon. Blight appeared on early varieties at several places in South Devon on July 7, and in East Devon on July 21. Main crop varieties began to be attacked at this date but the spread was very slow. More rapid progress was observed in Cornwall in the first week in August, but the epidemic was slight in Devon until the last fortnight in September. As a result of the late development there were many cases of tuber infection being above normal. In one case at Crediton, 50% of the crop of Up-todate was diseased, while Majestic in the same field was unaffected.

Dry Rot was again widespread and troublesome, and Black Leg was frequent. Common Scab was more prevalent than usual, probably on account of the shortage of rain in the summer.

Mosaic and Leaf Roll were frequent, but Streak was generally slight.

White Root Rot (*Rosellinia necatrix*) was observed in Devon for the first time.

BROAD BEANS

Chocolate Spot was severe in South Devon on one of the few autumn sown fields that survived the wet winter. It was also bad on a farm in Cornwall where it occurs every year, in spite of all practicable precautions. Elsewhere the disease, though common, did no damage.

Rust was not serious, and Leaf Spot (*Ascochyta fabae*) was occasional.

VEGETABLES

Most vegetable diseases were below normal. Ring Spot was locally severe on Brussels Sprouts in the autumn of 1936, but was not generally common on any crop in 1937. Downy Mildew was common on Broccoli seedlings in the summer in Cornwall.

Lettuce suffered appreciably from Downy Mildew (*Bremia Lactucae*) in the autumn of 1936, but there was little damage in the summer of 1937. Grey Mould (*Botrytis cinerea*) was often troublesome, and there were cases of severe damage from Ring Spot.

Endive again suffered from Leaf Margin Rot in West Cornwall at the end of 1936. It has not yet been possible to make certain if the disease is bacterial or primarily physiological.

Mint Rust was frequent.

Rust (*Uromyces Betae*) and Leaf Spot (*Ramularia beticola*) were observed on Spinach Beet at Newton Abbot.

There were several cases of White Rot in onions in Devon and one severe case of Downy Mildew.

Halo Blight was common on both Runner Bean and Dwarf Bean, but is not regarded as serious.

Tomato Leaf Mould was about normal. There were a few severe cases of Stripe and many complaints of Blossom End Rot when the dry weather began. There was less Spotted Wilt than usual, and many outdoor crops escaped Blight.

FRUIT

Apple Scab was abundant in spite of the dry summer, being probably given a good start by the humid month of May. Blossom Wilt was scarce, and Mildew was slight, but Brown Rot was plentiful. There were several enquiries about Bitter Pit. Silver Leaf was noted on a young tree of Cox's Orange Pippin.

A young plantation in South Devon suffered severely from Canker, particularly the varieties Cox's Orange Pippin, Charles Ross, King of the Pippins. The disease was confined to trees on type IX stocks, those on type I in the next field being healthy. Bud Rot was again observed on the variety Grenadier and the fungus *Fusarium fructigenum* was isolated from affected buds early in January.

In the late autumn of 1936 many trees in an orchard in South Devon showed extensive brown decay of the bark at the base of the trunk. A number of secondary fungi were found, but there was no trace of any fungus known to be a primary parasite. It was noticed that all the trees had been loosened during gales, thus damaging the roots and base of the trunk. Some of the trees died and others showed reddening and premature withering of the leaves. Wind damage of this type was noticed on occasional trees in many other orchards.

Scab was severe on Pear, and the fruit was often very badly blackened on unsprayed trees. Pears suffering from Bitter Pit were received in August.

Quince Leaf Blight was found on both Pear and Quince in a garden near Exeter. Spores were abundant on the Quince leaves and were also found on the Pear, though said to be rare on this host. The pear trees were in the same garden as the Quince, though none of them was in contact with it, and spores were found on pear leaves of trees up to sixty feet away.

American Gooseberry Mildew appeared in the middle of May and developed strongly and became very severe on unsprayed bushes, passing on to Black Currants in a few cases.

Peach Leaf Curl was frequent, spraying giving satisfactory control in some cases and not in others. In two of the latter gardens affected Almond Trees were present which were too big to spray satisfactorily. There was a case of Silver Leaf on Peach in a glasshouse.

Pocket Plum occurs on the cultivated plum in some seasons, and there were several cases in 1937. Silver Leaf was plentiful and widely distributed, and was also observed on the wild Blackthorn.

Grape Vine Mildew was common; the first date noted being May 28.

Black Currant Leaf Spot was frequent as usual in the summer, and Rust was observed in a fresh locality.

Leaf Spot was also observed on Red Currant and also European Gooseberry Mildew which is now uncommon on any host.

Red Core was observed on Strawberries at four centres in the Tamar Valley, two of them directly related to last year's cases and two apparently new. Equally serious loss in the same district was caused by Crinkle, which appeared to increase very rapidly during the summer. Mildew was frequent though not serious, and there were few complaints of Grey Mould rotting the fruits.

The Root Rot fungi, *Armillaria mellea* and *Rosellinia necatrix* were both frequently recorded. The former caused the death of Apple and Pear and the latter of Apple, Plum, Peach, Almond, Pear, and Strawberry.

FLOWERS

The Narcissus White Mould epidemic was again a severe one. It began round Truro on February 8 on Golden Spur and became severe on this variety and on Ornatus Maximus everywhere in West Cornwall. It was severe in the Tamar Valley in March and April, but the bulk of the Double White crop escaped serious injury. The dry weather that checked the disease in this variety was, it is surmised, responsible for serious loss by inducing Blindness or failure of the flower buds to swell.

Fire (*Botrytis polyblastis*) was much less serious than in the previous season. Smoulder (*Botrytis narcissicola*) on the other hand was frequent, chiefly on trumpet varieties. Leaf Scorch (*Stagonospora Curtisii*) was below normal except for a severe attack on Sol d'Or in Scilly and on Gloriosus (French bulbs) in S. Devon.

Flower Spot caused much loss in Scilly in January and February. Some of it was due to *Stagonospora Curtisii*, but most was caused by *Botrytis polyblastis*. In other districts *Stagonospora* was the sole cause and the disease was below normal.

Root Rot has become increasingly troublesome in Scilly but is still of only local importance on the mainland.

There were several cases of Fusarium Bulb Rot in the summer in Cornwall, varieties affected including Sir Watkin, Victoria, and Emperor. Imported bulbs of Van Waveren's Giant and Victoria also suffered. The conditions that give rise to this bulb rot are not at present known, and in most seasons the disease is difficult to find in locally grown bulbs. An experiment was carried out during the summer of 1937. Daffodil bulbs, varieties Empress and Horsfieldii lifted from the College plots were stored in two large boxes without ventilation in order to see if Fusarium Bulb Rot would develop. There was no trace of the disease when the bulbs were examined on October 22.

The wet winter weather favoured the abundant development of primary infections of Tulip Fire with the result that the April epidemic was a severe one in both counties. The degree of control appeared to be directly proportional to the efficiency of the roguing of primary infections. No sprays were of any value. Shanking (*Phytopthora sp.*) caused severe loss in January in glasshouses near Plymouth.

Iris Leaf Diseases were below normal. Ink Spot was severe in some localities, but absent from most. Leaf Spot (*Heterosporium gracile*) was not observed on bulbous Iris except in Scilly though abundant later in the year on Flag Iris. Stripe was again common, often making the plants useless. Grey Bulb Rot was severe in one locality on Wedgwood in the field and on Imperator in forcing boxes.

A new disease of bulbous Iris, apparently caused by a species of *Phytopthora* was found in Scilly by Mr. G. W. Gibson, who states that he first saw it in 1928 on the variety Imperator and that it has recurred from time to time, but becomes obvious only in very wet winters. It causes greyish-white lesions on the leaves, ultimately turning purplish-brown. Dr. P. H. Gregory, also found the disease at Penzance on White Excelsior. It has not yet been possible to identify the species.

Leaf Spot (*Septoria Gladioli*) was very common on Gladiolas, variety The Bride in West Cornwall, and also occurred on Ne Plus Ultra and on wild gladioli in Scilly.

Grey Mould and Mildew were noted on Myosotis in Cornwall. Downy Mildew (*Peronospora parasitica*) was frequent and widely distributed on Wallflower but did no serious damage. *Botrytis elliptica* was troublesome on Lilies in Devon in the spring. Gerbera Leaf Spot (*Ascochyta Gerberae*) was found for the first time in Devon.

Marigold Smut (*Entyloma Calendulae*) did much damage in West Cornwall in the winter. This was probably due to the heavy continuous rains which caused affected plants to turn black and rot away. A variety trial was sown at Seale-Hayne on May 3, and at the end of July several plants were found to be attacked by a Rust, and it spread to all the varieties. The rust was *Coleosporium senecionis* which is very common on Groundsel, and this weed in the same plot also had the rust. This fungus has not been recorded before on Calendula, but it is interesting that it was seen about the same time by other observers in private gardens in Reading and Newton Abbot.

Anemones escaped very serious damage from "Winter Browning," though it was common in February and March. The next planting suffered from drought, and in West Cornwall also from Mildew (probably *Erysiphe Polygoni*). Many gardens were affected in September but the damage done was not large. In some cases the mildew was present on the flower stalks as well as on the leaves. Two new diseases appeared in a few localities, which might do much damage if they become widespread, viz, Downy Mildew (*Plasmopara pygmaea*) and rotting of corms and leafstalk bases by a strain of *Botrytis sp.* The former is recognised by a rapid blackening of the outer leaves. Aerial spores are formed on the leaf surface and resting spores may be produced inside the decayed leaf tissue. From the latter they would eventually pass into the soil which would then become infected. The second disease, which may be termed Corm Rot, is more local, and was found by Dr. P. H. Gregory in West Cornwall. Sclerotia, or resting bodies, are formed on the corms and leaf bases, both of which become decayed. Cultures made from the sclerotia closely resemble cultures of *Botrytis cinerea*. The previous crop in each case was lettuce, which suggests the possibility that the fungus came from the remains of that crop. The harmless Myxomycete *Physarum cinereum* was found on Anemone flower stalks in several localities in the early spring.

Anemone fulgens was found by Dr. P. H. Gregory to be attacked by Rust (*Puccinia Pruni-spinosae*). The fungus was not present in every organ of the plant as is usually the case with Anemone coronaria, but both normal and affected leaves occurred on the same plant and sometimes there were even normal and affected parts in the same leaf.

Mildew is universal on Michaelmas Daisies grown for market, and is readily controlled by growers by dusting with sulphur. One of these crops in the Tamar Valley sustained considerable loss from Wilt (*Verticillium Vilmorinii*), which is caused by the fungus living in the stools. Splittings from the latter, therefore, carry the disease, thus explaining its presence in the plantation of another grower who obtained his plants from the previous grower.

There were several cases of White Mould (*Cladosporium album*) on Sweet Peas in Devon. A leaf spot of Petunia caused by the fungus *Ramularia Petuniae* did considerable damage to pot plants under glass in July in Plymouth. It caused irregular yellow spots which destroyed a large part of the foliage. According to Mr. W. C. Moore, the only previous record of the disease is

that by M. C. Cooke in 1891 (Gard. Chron. Vol. 10, 1891, p. 114). Strangely enough, this was also at Plymouth, but it was not possible to establish any evidence of a connection between the two cases.

Chrysanthemum Rust was remarkably scarce in the autumn of 1936, but several cases were seen out of doors in September, 1937. Snapdragon Rust though plentiful in 1937, was less serious than in previous seasons. It was first observed at Newton Abbot on July 14th, and also started in N. Devon early in July. Five resistant varieties were grown at Seale-Hayne alongside a susceptible variety, but the attack of Rust was less severe than in previous seasons, so that definite conclusions could not be drawn. F. D. Rooseveldt, California Supreme, Red Boy suffered as severely as the susceptible variety Nelrose, but Camp Fire and Carmine Rose suffered very little and promise to be useful varieties.

Rosellinia necatrix did damage to Montbretia and Iris stylosa in an East Devon garden, and *Armillaria mellea* was causing the death of Paeony plants in the Tamar Valley.

ORNAMENTAL SHRUBS AND TREES

Dutch Elm disease is maintaining itself, and attracted considerable attention during the year from the number of trees attacked, which from their position were of great ornamental value.

Mildew was plentiful, and Black Spot severe on Roses, and there were a few severe cases of Rust. The bush rose Margaret McGredy was particularly severely attacked in North Devon.

Armillaria mellea caused the death of Privet, Lilac, and Broom, and *Rosellinia necatrix* attacked Privet and Jasminum officinale.

APPENDIX I,

PESTS REPORTED IN DEVON AND CORNWALL

This list comprises those insects not reported in the twelve previous years and those occurring on host plants previously unrecorded.

POTATOES

Rhynchota		
Aphis rumicis, Linn.	Potato.	Devon and Cornwall.
Aphis rhamni, Boyer	Potato	Devon and Cornwall.
Macrosiphum gei, Koch	Potato	Devon and Cornwall.
Myzus ornatus, Laing	Potato	Devon and Cornwall.

VEGETABLES

Rhynchota		
Aphis rumicis, Linn.	Spinach Beet.	Devon.

FRUIT

Lepidoptera		
Anthophila pariana, Clerck.	Apple.	Devon.

FLOWERS

Rhynchota		
Macrosiphum gei, Koch.	Iris tingitana	Devon. In open.
Lygus pabulinus, Linn	Gerbera Jamesoni.	Capsid damage to flowers in open in Devon.
Aphis rumicis, Linn.	Gerbera, Calendula, and Anthemis.	Devon.
Macrosiphum gei, Koch.	Gerbera.	Devon.
Lepidoptera		
Cnephasia conspersana	Iris.	Isles of Scilly.
Nematoda		
Aphelenchoides olesistus Ritz-Bos.	Auricula, Primula Wilsoni, P. beesiana and P. pulverulenta	This eelworm found associated with dwarfing in these plants.

MISCELLANEOUS

Rhynchota		
Aphis rumicis, Linn.	Elder	Devon.
Aphis pomi, De Geer	Siberian Crab	Devon.
Adelges piceae, Ratz.	Silver Fir	Causing large galls. Devon.
Diptera		
Mitodiplosis spp.	Rust on Mint	Larvae feed on Rust on mint in Cornwall.

APPENDIX II.

FUNGAL DISEASES IN DEVON AND CORNWALL

The following is a list of additions to the lists given in previous Annual Reports. Those indicated by an asterisk have not been seen by us but are given on the authority of W. B. Grove's "British Stem and Leaf Fungi," vol. 2 (1937).

	CEREALS	
Wheat		
Foot Rot	*Cercosporella herpotrichoides* Fron.	Devon
	PASTURE	
Timothy		
Rust	*Puccinia Phlei-pratensis* E. and H.	Devon
	VEGETABLES	
Carrot		
White Root Rot	*Rosellinia necatrix* (Hart.) Berl.	Devon
Cucumber		
Mosaic	Virus	Devon
Horse Radish		
Pale Spot	*Ramularia Armoraciae* Fuck.	Devon
Radish		
Scab	*Actinomyces* sp.	Devon
Spinach Beet		
Leaf Spot	*Ramularia beticola* Fautr. and Lamb.	Devon
	FRUIT	
Pear		
Bitter Pit	Non-parasitic	Devon
Leaf Blight	*Fabraea maculata* Atk.	Devon
White Root Rot	*Rosellinia necatrix* (Hart.) Berl.	Devon
Red Currant		
European Mildew	*Microsphaera Grossulariae* (Wallr.) Lev.	Devon
Reversion	Virus	Devon
Strawberry		
White Root Rot	*Rosellinia necatrix* (Hart.) Berl.	Devon

Walnut		
Bacterial Blight	*Pseudomonas Juglandis* Pierce	Devon

FLOWERS AND ORNAMENTAL SHRUBS

Acacia		
Root Rot	*Armillaria mellea* (Vahl) Fr.	Devon
Almond		
Leaf Curl	*Taphrina deformans* (Berk.) Tul.	Devon
White Root Rot	*Rosellinia necatrix* (Hart.) Berl.	Devon
Anemone		
Corm Rot	*Botrytis* sp.	Cornwall
Downy Mildew	*Plasmopara pygmaea*, Schroet.	
Mildew	*Erysiphe Polygoni* DC	Cornwall
Leaf Spot	*Septoria Anemones* Desm. var. *Coronariae* Grove	Cornwall
*Leaf Spot	*Leptothyrium Anemones* Grove	Scilly
Aristotelia Macqui		
*Leaf Spot	*Gleosporium Aristoteliae* Sm. and Ramb.	Devon
Broom		
Root Rot	*Armillaria mellea* (Vahl) Fr.	Devon
Calendula		
Rust	*Coleosporium Senecionis* Fr.	Devon
Clematis		
Dieback and Leaf Spot	*Ascochyta* sp.	Devon
Euonymus japonicus		
*Leaf Spot	*Pestalotia neglecta* Thum.	Cornwall
Gerbera		
Leaf Spot	*Ascochyta Gerberae* Maffei	
Hippeastrum		
Spotted Wilt	Virus	Devon
Iris		
Leaf Blight	*Phytophthora* sp.	Cornwall
Iris stylosa		
White Root Rot	*Rosellinia necatrix* (Hart.) Berl.	Devon

Jasminum officinale		
White Root Rot	*Rosellinia necatrix* (Hart.) Berl.	Devon
Laburnum		
Root Rot	*Armillaria mellea* (Vahl) Fr.	Devon
Lavender		
Leaf Spot	*Septoria Lavandulae* Desm.	Devon
Lily		
Mosaic	Virus	Devon
Montbretia		
White Root Rot	*Rosellinia necatrix* (Hart.) Berl.	Devon
Petunia		
Grey Mould	*Botrytis cinerea*, Pers.	Devon
Leaf Spot	*Ramularia Petuniae*, Cooke	Devon
Phormium tenax		
*Leaf Spot	*Coniothyrium Phormii*, Cooke.	Cornwall
Photinia japonica		
*Leaf Spot	*Entomosporium maculatum* Lev.	Cornwall
Polyanthus		
Leaf Spot	*Ramularia Primulae* Thum.	
Privet		
White Root Rot	*Rosellinia necatrix* (Hart.) Berl.	Devon
Prunus persica alba pendula		
Leaf Curl	*Taphrina deformans* (Berk.) Tul.	Devon
Rhododendron		
Rust	*Chrysomyxa Rhododendri* de Bary	Cornwall
*Leaf Spot	*Diplodina Eurhododendri* Voss	Cornwall
Sunflower		
Sclerotinia Rot	*Sclerotinia sclerotiorum* (Lib.) de Bary	Devon
Tagetes		
Foot Rot	*Phytophthora* sp.	Devon
Tulip		
Shanking	*Phytophthora* sp.	Devon
Water Lily		
Leaf Spot	*Ovularia Nymphaearum* Bres. and Allesch.	Devon

Seale-Hayne College Pamphlets

Pamphlet	16.	First Annual Report of the Department of Plant Pathology.
,,	17.	Cost of Milk Production. (3rd Report). (Out of Print).
,,	18.	Potato Variety Trials, 1925.
,,	19.	Second Annual Report of the Department of Plant Pathology.
,,	20.	Potato Variety Trials, 1926.
,,	21.	Third Annual Report of the Department of Plant Pathology.
,,	22.	Purity of Strain in Red Clover.
,,	23.	Economic Investigation of Devon and Cornish Farms.
,,	24.	Variety Trials with Potatoes. Four years. (Final Report). (Out of Print).
,,	25.	Fourth Annual Report of the Department of Plant Pathology.
,,	26.	Grassland Management. (Out of Print).
,,	27.	Report of Advisory Departments.
,,	28.	Tables of Composition, Nutritive and Manurial Values of Food.
,,	29.	Report on the Elimination from a Dairy Herd of Cows reacting to the Tuberculin Test.
,,	30.	Fifth Annual Report of the Department of Plant Pathology.
,,	31.	Sixth Annual Report of the Department of Plant Pathology.
,,	32.	The Manufacture of Butter.
,,	33.	Sugar Beet Costs in Devon and Cornwall.
,,	34.	Guide to Exhibit at the World's Poultry Congress (1930).
,,	35.	Clotted Cream.
,,	36.	Seventh Annual Report of the Department of Plant Pathology.
,,	37.	Eighth Annual Report of the Department of Plant Pathology.
,,	38.	A Study of Livestock Movements in Cornwall and Devon.
,,	39.	Bacillary White Diarrhoea of Poultry.
,,	40.	Ninth Annual Report of the Department of Plant Pathology.
,,	41.	Labour Requirements of Crops and Stock in the South-West.
,,	42.	Tenth Annual Report of the Department of Plant Pathology.
,,	43.	Changes in Permanent Equipment of South Devon Farms.
,,	44.	Eleventh Annual Report of the Department of Plant Pathology
,,	45.	Changes in the Practice of Sheep Farming on the Red Loams of Mid-Devon.
,,	46.	Twelfth Annual Report of the Department of Plant Pathology.
,,	47.	Thirteenth Annual Report of the Department of Plant Pathology

W. HENDERSON HOGG,

April, 1938. *Principal.*